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Study on the Strategies for Developing a Safety Culture in Industrial Organizations

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Abstract

As the concept of "safety culture," however, contains abstract elements, it is difficult to find a way to establish it in a specific manner in an organization, resulting in the current failure of its effective development. The result of developing a specific method for evaluating safety culture (SCAT: Safety Culture Assessment Tool) from the perspective of safety management in industrial organizations is reported. In addition, a comprehensive program for the continuous assessment and improvement of a safety culture (PDCA cycle) based on the use of SCAT, as a strategy for developing a safety culture, is examined and proposed. For contribution to further studies, reflections were also given on problems with activities for improving and entrenching a sound safety culture in an organization.

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1. The background and purpose of this study

As there have been still various accidents and troubles frequently in recent years, the Ministry of Economy, Trade and Industry of Japan has conducted a survey on direct causes for industrial accidents that have occurred since 2002. Its result shows that more than 70% of all accidents were caused by human factors including mismanipulation, misjudgement, and defective manuals. In particular, it was indicated that 90% of accidents that had occurred in the steel industry were caused by human factors [1]. Consequently, how to prevent a human error has been on agenda at the front line, and much activity has actually been carried out for this purpose.

As a part of those measures for preventing human errors, the concept of safety culture has gradually been accepted not only by the nuclear power industry, in which it originated, but also by other industries. The concept of "safety culture," to begin with, was first introduced by the investigation report on the Chernobyl Accident which occurred in 1986 by the International Atomic Energy Agency (IAEA), *Summary Report on the Post-accident Review Meeting on the Chernobyl Accident* [2]. Although the cause of Chernobyl Accident was initially attributed to an "operator error," as the post-accident investigation proceeded, it was revealed that the main cause of the accident was not an operator error but many complex organizational factors. An effective regulatory scheme was not established at the national level. No adequate safety analysis was made by the designers and at the plant level. In addition, due to the sloppy maintenance of rules and procedures, a system was not established that adequately ensure the safety of the reactor. Consequently, it ended up as an accident whose root causes were indicated to be the nature of the former USSR society and the "absence of safety culture" in the nuclear power management organization.

Also in Japan, due to successive waves of scandals such as the Criticality Accident at JCO's Tokai nuclear fuel plant in 1999 and TEPCO's cover-up of nuclear reactor problems in 2002, the importance of organizational climate, such as an entire organization's attitude and behaviors toward safety, came to be further recognized, and it came to be

strongly demanded to develop an organizational climate for ensuring safety, that is, safety culture. As the concept of "safety culture," however, contains too abstract elements, no way is found to establish it in a specific manner in an organization. This bottleneck has resulted in the current failure of its effective development. This study is thus intended to examine strategies for developing a safety culture in an industrial organization from the perspective of safety management.

2. Perspective of safety management

There are two mistaken ideas about a human error which are often heard at the front line of an industrial organization [3]. One is fatalism about a human error. Specifically it rests on the recognition that humans are error-prone creatures. Therefore, a human error is unavoidable, and nothing can be done about it. We should thus be resigned about it. Such is the attitude taken by fatalists about a human error. Another is responsibility, so to speak, about a human error. This is an idea based on a short-sighted response which tries to call attention by pursuing the responsibility of an individual who caused an error and punishing him/her. As may have already been understood, fatalism as a causal account does not contribute at all to preventing a human error, and responsibility cannot be said to be scientific in developing countermeasures. Accidents will never be eliminated if the parties to an accident are found fault with and punished or dismissed to address the cause of the accident. It must be recognized that any person inherently has a possibility to cause an accident if placed under certain circumstances since human behaviors fluctuate. An approach based on science does not stop at determining the responsibility for an accident but actively pursue the root cause for its occurrence.

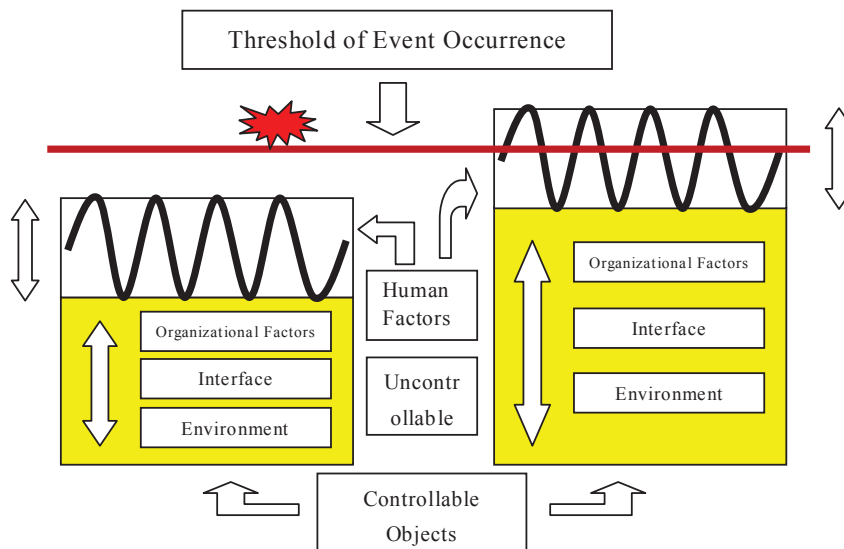


Fig. 1. Perspective of safety management

As indicated in the Figure 1, at a workplace, individuals work under the support of an organization (such as structure and institution). Behaviors of a human being as an organism are not always in a steady state but have constant fluctuations (characteristic nature of human beings). Traditional studies on human factors have conceivably been intended to minimize such "fluctuations." We think, however, that such approaches must probably be efforts that can only be "left to the hand of God." Based on this view, there are no means of response available to us human beings than controlling the "organizational factors" constructed by human beings. There is no doubt such "organizational factors" can be controlled "since they were created by us human beings." Under this conception, it is aimed at to make an error remain a near miss even in the worst case and to prevent it from leading to a large accident even if the error is committed by a human being. In short, in many cases, an event which is described as a human error is, in fact, not the result of inappropriate behaviors by individuals but something whose cause should be attributed to an administrative flaw of an organizational system. Let us note that the greatest agenda for safety management is how to improve the safety management system of an organization.

3. Strategies for developing a safety culture

3.1 Grasping an organization's state of safety

As the first step in constructing a safety culture in an organization, it is indispensable to grasp its existing state of safety and clarify its weakness. One of major issues in grasping the current situation is, however, how to recognize and evaluate a safety culture. Consequently, in response to a voice from the front line, "A safety culture is abstract and difficult to understand," let us introduce a method for measuring a safety culture developed by the Institute for Science of Labour in Japan, to which the authors belong, and a sample result of its application, as an example of research working on the "visualization" of safety culture [4].

First, items falling under the "mechanism for safety assurance (scheme, mean, and activity)" were extracted from those concerning an operating organization (756 in total) in the ASCOT Guidelines proposed by IAEA. Those items are in 10 areas: "safety statement," "safety and productivity," "rules and documentation," "responsibility, authority, and roles," "troubleshooting," "education and training," "information channel and communication," "working conditions," "institution and activities," and "cooperation with outsiders." Next, core assessment items were selected from each of these areas to elaborate (a total of 36) items/questions for assessing "safety attitudes and behaviors."

Another important component of safety culture is the "extent to which safety attitudes and behaviors are shared." Since a safety culture is a culture, its important element is "whether safety attitudes and behaviors are shared by members of an organization." As one way to have this element reflected in assessing each of those items we formulated, members of an operating organization were classified into three cohorts (occupational groups)—"managers," "field supervisors," and "operators"—and asked to evaluate each other in three ways (between managers and supervisors, managers and operators, and supervisors and operators). The gaps between ratings by different cohorts thus obtained were used as a rating for the extent to which "safety attitudes and behaviors" are shared. Thirty-six assessment items/questions mentioned above and this framework of evaluation thus created are named "SCAT: Safety Culture Assessment Tool."

The example shown in the radar chart in Figure 2 is the result of the evaluation of managers at one business establishment using SCAT. The result clearly shows that the self-evaluation score by managers is greater than ratings by other cohorts, both supervisors and operators, in every area of assessment and that there are large gaps in ratings in two items: "safety and productivity" and "information channel and communication." Represented in this way, the result gives clues for what the problems are for improving the organizational safety culture in this establishment and what they should start with in taking countermeasures.

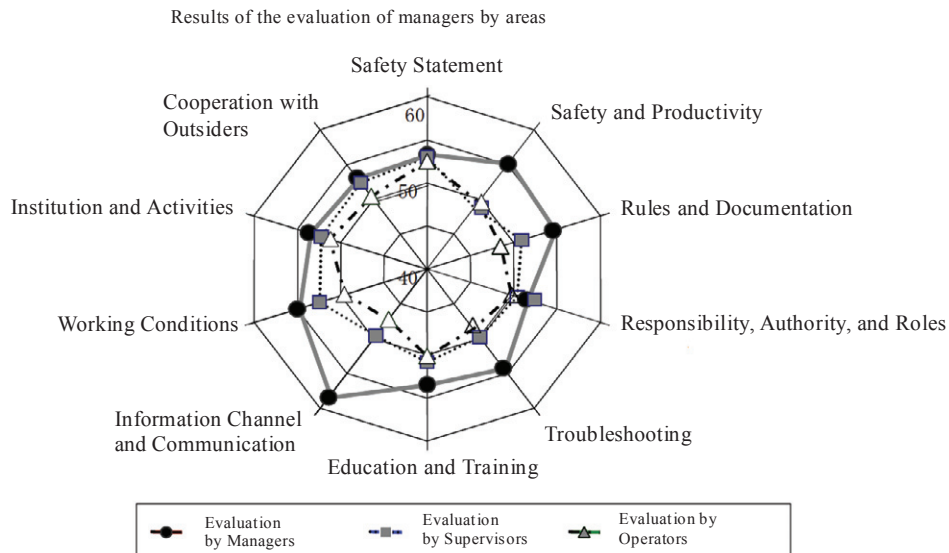


Fig. 2. Result of measurement using SCAT

In addition, the SCAT provides a framework for the comprehensive assessment of an organization in terms of safety culture based on two indices of rating and rating gap (abbreviated as SCAT-MAP). Under this framework, rating gaps between cohorts (called G scores) are taken along the vertical axis, and ratings for items (called E

scores) are taken along the horizontal axis. The relative position of a given organization is to be found on the basis of these two dimensions. The following is how it works. By combining different types of G scores and E scores, safety culture levels are categorized into four types (GE, Ge, gE, and ge), making it possible to classify every organization into one of these types. These four types are characterized as follows.

Type GE (high item ratings and small rating gaps): Although this is an ideal type from the perspective of safety culture, an organization of this type can be complacent.

Type Ge (low item ratings and small rating gaps): Although the ratings in safety attitudes and behaviors are generally low with an organization of this type, it is easy to be united in introducing new measures because of small rating gaps. It can therefore be expected to improve. It can, however, be said to be in a stagnant state at present.

Type gE (high item ratings and large rating gaps): Although the ratings in safety attitudes and behaviors are generally high with an organization of this type, its problem is large rating gaps among cohorts. It can be united as an organization by eliminating the difference in mutual recognition through increasing exchanges among cohorts. At present, however, distrust is considered to exist among cohorts.

Type ge (low item ratings and large rating gaps): Since the ratings in safety attitudes and behaviors are generally low and rating gaps are large among cohorts, this type of organization needs a significant organizational reformation.

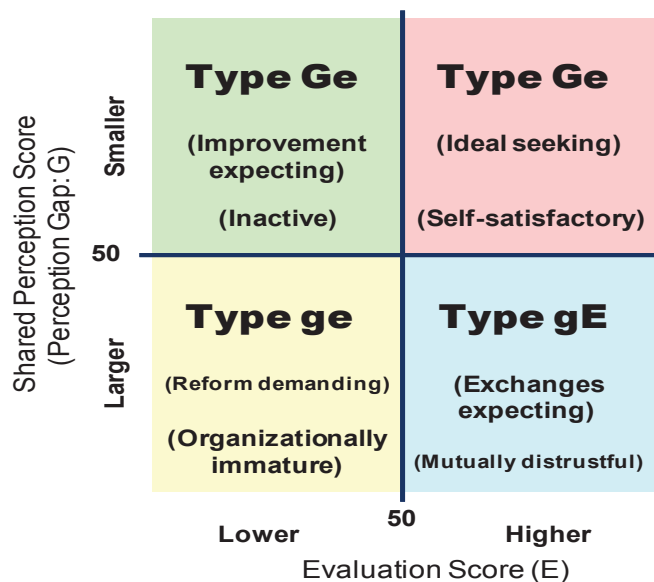


Fig. 3. Assessment Model Using SCAT-MAP

3.2 Detecting an organization's vulnerabilities by using SCAT

A comparison of organizations becomes possible by grasping the characteristics of the safety culture of each organization as a whole and using SCAT-MAP at the same time. In addition, representing results of evaluation for each assessment area and item in an organization on this SCAT-MAP enables detecting its vulnerabilities with greater specificity. The results of assessment of many business establishments which so far been made by the Institute for Science of Labour are shown on the SCAT-MAP (Figure 4). Representing the results on such a map makes the relative position of the safety culture of a given business establishment clear at a glance and enables its comparison with other establishments.

3.3 Identifying elements impeding safety culture and creating responses

A necessary step after detecting vulnerabilities of an organization by using SCAT is to clarify what lets such vulnerabilities exist in the organization (factors inhibiting safety culture). Unless factors inhibiting safety culture are identified and steps are taken to address them, it will not lead to the fundamental solution of problems. An

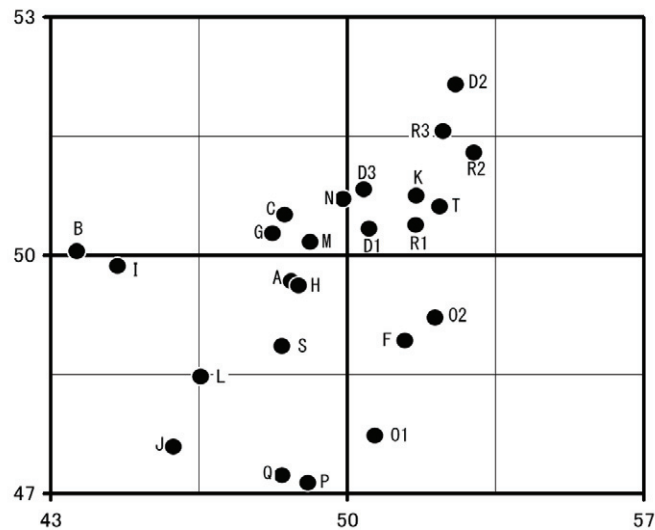


Fig. 4. Examples of the Assessment of Numerous Business Establishments Represented on a SCAT—MAP

interview (interview method) is one of effective ways to probe for the background factors for the problems. It is effective to analyze the background factors by conducting a detailed hearing concerning problems detected by SCAT with randomly selected members of each of cohorts (managers, supervisors, and operators) about the routine state of operations (management, behavior patterns, attitudes, human relations, etc.) of the entire organization including teams and individuals. If, in addition, appropriate steps are taken to address the group of causes abstracted, the strategy for ensuring safety will advance further. One such example is shown in Table 1.

Table 1. Example of the result of a hearing based on SCAT

Opinions of the Management	Opinions of the Front Line
Operators work in accordance with the rules only when we conduct a field patrol.	Managers do not understand the actual situation at the front line.
Regrettably, we cannot leave things to the front line as things stand now.	There are many rules and manuals that do not match the situation on the front line.
An opinion that 100% performance in both production and safety is impossible is an excuse.	Managers demand incompatible things such as both "improving productivity" and "complete conformity to the rules."
The reason why lessons learned do not spread horizontally is that the front-line people have an attitude that "that has nothing to do with me."	Managers do not respond even if we make a request for improvement.
Proposal (Countermeasures):	
1. Reflect the opinions of the front line in making rules.	
2. Review the way of field patrol.	

3.4 Entrenching a safety culture by PDCA

Once the construction of a safety culture has been achieved, the next problem is that an industrial organization as an organism will immediately let fading of effectiveness start inside, as is obvious from the existing findings in organizational research. Therefore, we propose a program of running the following PDCA cycle in order to entrench a safety culture in an organization. (1) Identify the weakness of an organization through a survey using

SCAT. (2) Corroborate the weakness identified by a hearing survey. (3) Create and implement a response to the weakness confirmed, for each of three cohorts (managers, supervisors, and operators) (a yearly program by default). (4) Inspect the course of implementation by monitoring surveys (every 3 month by default). Revise the program if there is a delay in implementation. (5) Conduct a SCAT survey again to measure the effect of the response.

An important point at the stage of drafting the response is to focus on a single specific measure that is feasible as much as possible. A measure which tends to be all-encompassing such as "improving communication within an organization" or "making communication smoother" blurs its focus and makes the scope of activities too wide. The key point is that all members of the organization work together on even a single small program throughout a year and obtain the sense of achievement (success experience). This experience of achievement has been found to lead to a concomitant improvement (as a side effect) in other weaknesses of the organization which have not been covered by the response taken.

4. Discussion

A comprehensive program for developing a safety culture (PDCA cycle) primarily by using SCAT from the perspective of safety management in order to prevent human errors was examined and proposed. It goes without saying that extremely slow and steady efforts are required for developing and entrenching a safety culture in an existing organization. Since this is an activity to create a culture in an organization, it is unavoidable that it takes time. Nonetheless, upon witnessing the nuclear power plant accident at Fukushima, which occurred in Japan (see the Interim Report by the Accident Investigation Committee of the Japan's Government and other documents for details), we think that we are compelled to incorporate a safety culture into corporate activities in the future even if it takes time.

Safety consciousness and behavior are acquired not naturally but only as a result of the effective deployment of various activities. Therefore, although it is necessary to evaluate the result, what is more important is that an organization constructs "a mechanism for continuously improving safety" and has substantial routine activities for enhancing safety. In addition, it can be said to be even more important to monitor the soundness of the mechanism by focusing on the "process" leading to the result, for instance, whether the mechanism is actually functioning or not. In short, the approach consisting of "the continuous assessment and improvement of a safety culture in an organization and the inspection of the course of their implementation" is the key for developing a safety culture. Lastly, let us indicate the following problems as the future agenda for organizations in implementing "an approach toward the continuous improvement of a safety culture."

First, it is a requisite condition for the continuous improvement of a safety culture that a group which is in the center of an organization and plays a central role in the management of an organization undergoes "cognitive transformation" (changes their current conception of safety management). In reality, however, there may be no members of the organization in question who may work on this group for such transformation. That is, members of such a group have to tackle a very difficult task of "urging themselves to change themselves." Let us note that this is a task which can only be achieved by people who have a great enthusiasm for safety problems and have an excellent self-insight.

Next, it is important that all members of an organization share the recognition that it is difficult to show the effect of measures concerning organizational attributes such as culture or climate that are difficult to observe directly in a short-term and in a tangible manner. In cases often actually observed, people hastily demand some results or argue for or against the measure in question in a short-sighted manner, saying "Nothing has changed" or "It became rather more difficult to do such and such." Demanding results in a short-sighted manner lowers the motivation of members of the organization, which can stagnate or frustrate activities for improving a safety culture. All members of the organization must be aware of the fact that developing a culture takes a long time before they start this.

Thirdly, there are diverse implications of the word "culture". Some specific examples of behaviors are what suggest them: arbitrarily setting the goal of a safety culture, saying, "Now this is enough," arbitrarily setting the balance between safety and productivity (putting a greater priority on money than culture), or eliminating elements which are not reducible to procedures ("I cannot deal with such a vague thing as culture"). We must be aware of the fact that a culture is something that exists behind specific procedures and becomes manifest only after you have become familiar with procedures. In other words, this is an idea that there is no end to the development of a culture and that it must be continued without interruption. Once you stop your thinking and activity, it starts retrogression.

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